Skin Prick Test and Tonsil Size in Children: Any Relation?

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Abstract We hypothesized, allergic reactions of the tonsillar mucosa may cause secondary lymphoid hypertrophy in children. To evaluate this, we compared tonsil sizes and skin prick test results. Children of ages 6–12 years were divided into two groups according to the results of the skin prick tests (SPT), as atopic and non-atopic groups. All tonsil sizes were evaluated by the same observer using the Brodsky L. Scala. No statistically meaningful difference was found between the tonsil sizes of the atopic and the non-atopic groups of children. No statistically meaningful correlation was found between tonsil sizes and allergen sensitivity degrees. Even though some highly allergic children were observed to have large tonsils, it was not statistically meaningful. Since no correlation is found between SPT and tonsil sizes, allergy may not be an etiologic factor of tonsillar hypertrophy in children.

Keywords Tonsil size · Tonsillar hypertrophy · Skin prick test · Allergy

Introduction

The palatine tonsils are exposed to inhaled bacteria and antigens due to their anatomic location [1]. Lymphoid hypertrophy is observed in the intestine of patients with celiac disease whose etiology includes antigenic stimulation [2]. A similar reaction may be hypothesized to happen in the Waldeyer's ring. Allergic reactions on the mucosal surfaces of adenoids and tonsils may facilitate viral insults, followed by secondary bacterial colonizations [2]. It could be logical that this situation may lead to chronic local infections with secondary lymphoid hypertrophy [2]. We could not find any specific studies on a possible relation between allergy and tonsillar hypertrophy, and decided to investigate such a possibility. We designed a study which evaluates allergenic reactions and tonsil size in parallel in a pediatric group.

Materials and Methods

73 children (age range 6–12, mean 8.20 SD $\pm$ 1.67 37 female) were included in the study. Children with acute and chronic upper respiratory tract infection and with craniofacial anomalies were excluded from the study. Informed consents were obtained from all parents. The subject children were divided into two groups through skin prick tests (SPT). Those showing abnormal immediate reactions to certain allergens were grouped as atopic and those showing no significant reaction were grouped as non-atopic. The atopic group numbered 36 and the non-atopic group 37.

All tonsil sizes were evaluated by the same observer using the Brodsky L. Scala conceived as follows [3];

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Table 1 Tonsil size distribution in atopic and non-atopic groups

Tonsil size	Atopic group n (%)	Non-atopic group n (%)	P
+0	2 (5.6%)	1 (2.7%)	χ^2 :5.233 P: 0.264
+1	7 (19.4%)	4 (10.8%)	
+2	10 (27.8%)	19 (51.4%)	
+3	13 (36.1%)	8 (21.6%)	
+4	4 (11.1%)	5 (13.5%)	

χ^2 Chi-square test is used

0: Tonsils are situated in the tonsillar fossa, with no impingement on the oropharyngeal airway.

+1: Tonsils sit just outside of the tonsillar fossa with obstruction of less than 25% of the oropharyngeal airway.

+2: Tonsils are readily seen in the airway where 25–50% of the airway is obstructed.

+3: Tonsils obstruct 50–75% of the oropharyngeal airway.

+4: Tonsils obstruct more than 75% of the oropharyngeal airway.

SPT were performed conventionally on the forearm. Subjects quit taking antihistamines 1 week before the tests. Histamine (1 mg/ml) was used as the positive control and the diluent (saline solution) was used as the negative control. Alk-Abello SPT, which contain the most important specific inhalation allergens; *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, Grass mix (*Dactylis glomerata*, *Festuca pratensis*, *Lolium preenne*, *Phelum pretense*, *Poa pratensis*), Seceale mix (*Avena*, *Hordeum*, *Triticum*, Seceale), Herbal mix (*Artemisia*, *Chenopodium*, *Plantago*), Trees mix (*Alnus glutinosa*, *Betula verrucosa*, *Corylus avellana*), *Quercus robur*, *Olea europea*, *Populus nigra*, *Alternaria alternate*, *Aspergillus fumigatus*, *Penicillium notatum*, Feather, Dog, Cat, Cockroach, and some specific food allergens, Egg yolk, Cow milk, Fish, Cacao, Hazelnut were applied. The results were obtained by determining the mean value (in mm) of the perpendicular diameters of the allergic wheals appearing in response to the allergens which were then compared with the values obtained during an analogous survey of the posthistaminic wheals (positive control) and the reactions of the negative control. Reactions smaller than 3 mm were disregarded.

SPT results were graded in increasing sensitivity degrees as follows [4]:

0: an allergenic reaction equal to negative control reaction.

1+: mean diameter of the allergen-induced wheal is greater than the reaction to the negative control and

smaller than half the diameter of the histamine-induced wheal.

2+: mean diameter of the allergen-induced wheal is equal to or greater than half the mean diameter of the histamine-induced wheal, but smaller than its full diameter.

3+: mean diameter of the allergen-induced wheal is equal to or greater than mean diameter of histamine-induced wheal, but smaller than twice the mean diameter.

4+: mean diameter of the allergen-induced wheal is at least twice as large as mean diameter of histamine-induced wheal.

Sensitivity degree of 0 was deemed non-atopic and 1+ to 4+ atopic.

NCSS (Number Cruncher Statistical System) 2007&PASS 2008 Statistical Software (Utah, USA) package has been used for the statistical analyses for evaluating the results. The qualitative data were evaluated using Chi-square test. Significance was accepted at $P < 0.05$ level.

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Results

Of the total of 73 subjects (age range 6–12, mean 8.20 SD $\pm$ 1.67 37/73 female) 49.3% (36/73) were observed to be atopic and 50.7% (37/73) non-atopic. In the atopic group, 5.5% (2/36) of the subjects had tonsil sizes 0, 19.4% (7/36) had +1, 27.7% (10/36) had +2, 36.1% (13/36) +3, and 11.1% (4/36) had tonsil sizes +4. In the non-atopic group 2.7% (1/37) of the subjects had tonsil sizes 0, 10.8% (4/37) had +1, 51.3% (19/37) had +2, 21.6% (8/37) had +3, 13.5% (5/37) had +4. There was no statistically meaningful difference between the tonsil sizes of the atopic and non-atopic groups, with the Chi-Square being 5.233 and P being 0.264 ($P > 0.05$) (Table 1).

Tonsil sizes were observed in parallel with sensitivity to the allergens. The single highest sensitivity degree of each subject was recorded against tonsil size. Of subjects with sensitivity degree of 1+, 2 (5.5%) had tonsil size +2; of those with 2+, 1 (2.7%) had +1, 2 (5.5%) had +2, 4 (11.1%) had +3, 1 (2.7%) had tonsil size +4; of those with 3+, 1 (2.7%) had 0, 4 (11.1%) had +1, 5 (13.8%) had +2, 4 (11.1%) had +3, 3 (8.3%) had +4; of those with 4+, 1 (2.7%) had +0 tonsil size, 2 (5.5%) had +1, 1 (2.7%) had +2, 5 (13.8%) had +3. These results did not manifest a statistically meaningful relationship between allergenic sensitivity and tonsil size (although, 12 subjects (33.3%) of sensitivity 3+ were observed to have tonsil sizes of +2 or

Table 2 Tonsil sizes against SPT sensitivity

Sensitivity degree	Tonsil size 0 n (%)	Tonsil size +1 n (%)	Tonsil size +2 n (%)	Tonsil size +3 n (%)	Tonsil size +4 n (%)	P
1+			2 (20.0%)			χ^2 :11.249 P: 0.508
2+		1 (14.3%)	2 (20.0%)	4 (30.8%)	1 (25.0%)	
3+	1 (50.0%)	4 (57.1%)	5 (50.0%)	4 (30.8%)	3 (75.0%)	
4+	1 (50.0%)	2 (28.6%)	1 (10.0%)	5 (38.5%)		

χ^2 Chi-square test is used

more), Chi-square being 11.249 and *P* being 0.508 (*P* > 0.05) (Table 2).

It is worth noting that the most prevalent allergen was *D. farina* (17%), followed by *D. pteronyssinus* (15%), Seceale mix (9.9%), Grass mix (9.9%) and Herbs mix (8.9%).

Discussion

Allergic rhinitis has been observed to be prevalent in western lifestyle countries during the past decades [5]. Inhalation allergens vary from region to region, the most common ones being pollens and dust mites. We found dust mites (*D. pteronyssinus*, *D. farina*) to be the most popular allergens as well. Allergic diseases are diagnosed through various methods such as differential counting of peripheral leukocytes, determination of eosinophils in nasal secretion smears, radioallergosorbent testing (RAST) and SPT. RAST of airborne allergens in children less than 3 years old is difficult because of insufficient antibody development [6]. SPT is considered to be the gold standard of allergy testing. However, SPT is invalid in children less than 6 years old since histamine response of the skin is diminished [7].

Recent studies show correlation between adenoid hypertrophy and allergy, but there are few studies which have investigated the significance of allergies in tonsillar hypertrophy. Adenoids, palatine and lingual tonsils constitute the major part of Waldeyer's ring. Because of their localization, these lymphoepithelial tissues act as bodyguards against airborne and alimentary antigens (bacteria, viruses, oral exogenous proteins). Tonsils and adenoids contain specialized lymphoid compartments which are responsible for the immune function [8]. Lymphoid hypertrophy follows antigenic stimulation as observed in intestine of patients with celiac disease. Withdrawal of antigenic stimulation leads to cessation of hypertrophy [2]. Vinke has shown the kinetics of the allergenic process in the nasal mucosa associated lymphoid tissue (NALT) of the murine. Tissue sections of NALT and the cervical lymph node have been explored by applying fluorescent die

into the intranasal mucosa of murine. The die remained in adenoid tissue 2 days longer than cervical lymph node, proving the primary role of allergy in NALT [9]. Palatine tonsils secrete antimicrobial peptides as part of the innate immune system, as they are exposed to antigenic stimulation. In a study by Bryborn, the level of S100A7 (antimicrobial peptide) in tonsils of allergic patients was found to be decreased. This altered immunological response leads to possible loss of the T helper type-1 (Th1) response, favoring Th2 activity, and may cause an allergic response [1]. However, Ceran et al. observed diminished tonsillar hyperplasia and chronic tonsillitis in asthmatic children. They surmised that Th1 predominance after chronic tonsillitis was less in the presence of asthma [3]. Yokoi et al. compared the distribution and localization of mast cells in the tonsils of non-atopic and atopic patients. They showed significantly higher amounts mast cells in inter-follicular areas of the non-atopic group compared to the atopic group. They also found significant increase in IgE in perivascular areas, crypts and subepithelial tissues in atopic patients but no increase of IgE in interfollicular areas in any group. They concluded that mast cells in interfollicular tissues might have another role in addition to allergic reactions [10]. With a prospective study of RAST in patients undergoing adenotonsillectomy, Carr et al. demonstrated that adenotonsillar hypertrophy in pediatric patients with obstructive sleep apnea was not related to the allergy. However, they noted that the localized allergic reactions in the upper respiratory tract should be worked on, instead of systemic IgE and skin tests [2]. So, the studies until now show ambiguous and controversial results.

Conclusion

We tried to find a correlation between tonsillar hypertrophy and SPT in children through a simple clinical study. Since our results were not meaningful enough to establish such a correlation, allergy may not be an etiologic factor of tonsillar hypertrophy in children.

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